



Installation Instructions

Part No: 30RA-900---006, 30RA-900---015, 30RA-900---016, 30RA-900---017,
30RA-900---018, and 30RA-900---019

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GENERAL

This book contains instructions for the installation and start-up of the Motormaster V electronic low ambient control on chiller models 30RA010-055.

This control varies condenser fan speed based on liquid pressure. The control is a Variable Frequency Drive (VFD) and is only compatible with motors rated for use with VFDs. The accompanying pressure transducer has a 0 to 5 vdc output range and a -40 to 460 psi range. The VFD provides a 5 vdc output for the transducer on pin 6.

This system is a reverse acting, proportional-integral (PI) control. The VFD will vary the motor speed to drive the liquid line pressure to the set point during ambient temperatures below 60 F (16 C). The set point is lower than a normal operating pressure during summer operation. At higher ambient temperatures, the fan will go to full speed (60 Hz or 50 Hz depending on model) and remain there since it can not go fast enough to bring the pressure down to the set point. When the VFD is at full speed, it acts just like a fixed speed fan.

When the ambient air temperature drops, a fan running at full speed draws too much air across the condenser coil to maintain a minimum condensing pressure/temperature. In these conditions, the VFD will slow down and begin to maintain a set point.

The VFD will display the set point as the default. The set point is displayed in speed as Hz and is configured by the start command jumper.

Operating modes are configured for R-22 with a set point of 135 psig on the liquid line.

NOTE: The drive is phase insensitive in regard to incoming line voltage. This means that the VFD will operate with any phase sequence of the incoming three-phase voltage.

The standard outdoor-air temperature limitation of the Aqua-snap chillers is 45 F (7.2 C) (sizes 010-018) and 32 F (0° C) (sizes 022-055).

The Motormaster V electronic control low ambient operation kit can be used to extend the system operation down to -20 F (28 C).

SAFETY CONSIDERATIONS

⚠ WARNING

Be sure power to equipment is shut off before performing maintenance or service.

Installing, starting up, and servicing air-conditioning equipment can be hazardous due to system pressures, electrical components and equipment location.

Only trained, qualified installers and service technicians should install, start up, and service this equipment.

When working on air-conditioning equipment, observe precautions in the literature and on tags, stickers, and labels attached to the equipment.

Follow all safety codes. Wear safety glasses and work gloves. Use care in handling equipment.

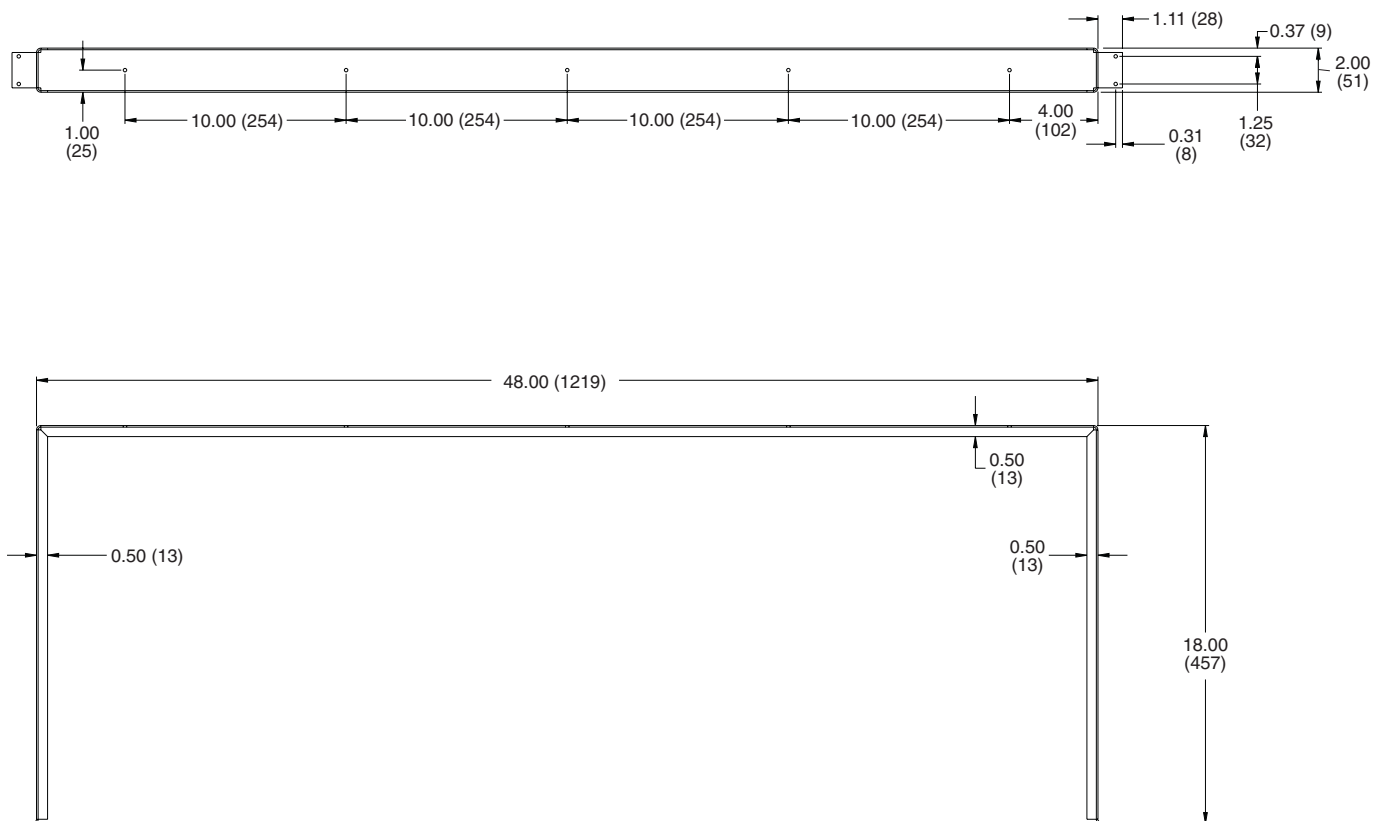
PREINSTALLATION

Inspect the contents of the accessory package before installing. File a claim with the shipper if you find shipping damage or contact your Carrier representative if any parts are missing. See Tables 1A and 1B for kit package contents.

INSTALLATION

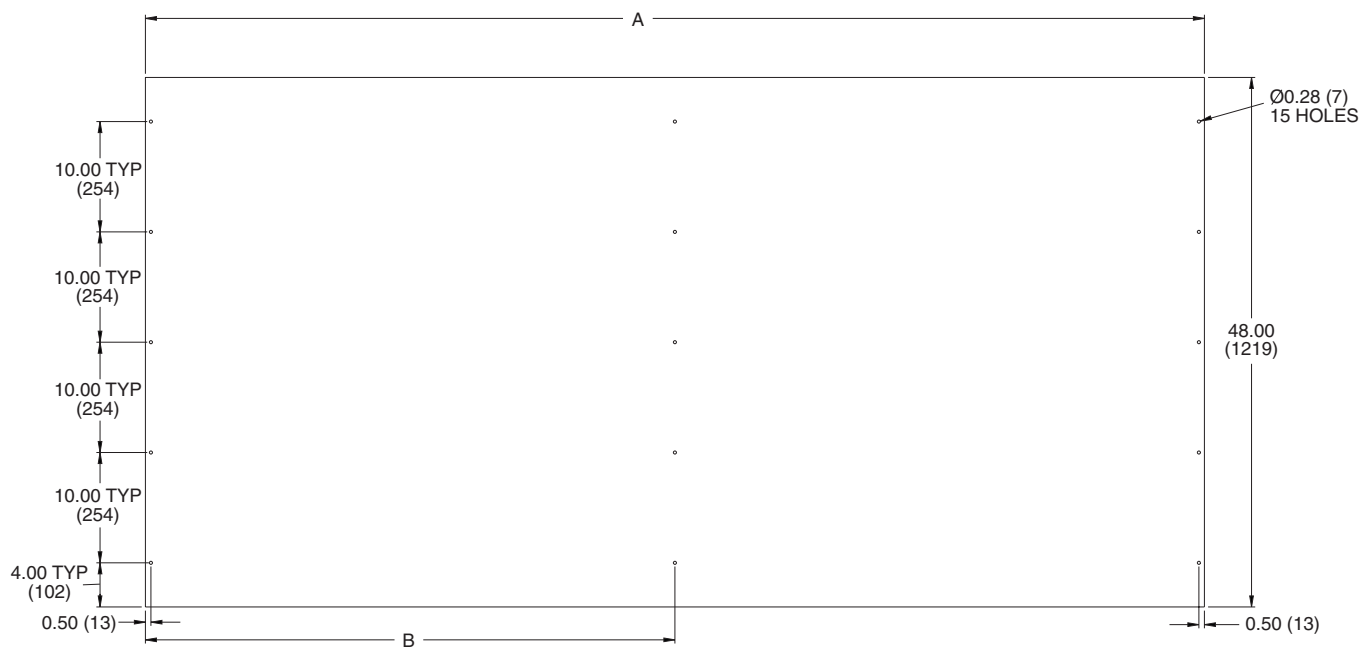
Install Wind Baffles and Brackets — Wind baffles and brackets must be field fabricated and installed for all units to ensure proper operation at low-ambient temperatures with Motormaster V electronic controller. Unit sizes 010-030 require one baffle, sizes 032-055 require two baffles. See Fig. 1 and 2 for the sizes and details of brackets and baffles required. See Fig. 3 and 4 for brackets and baffles location.

Use 14-gage galvanized sheet metal or similar corrosion-resistant material for the brackets and 20-gage for the baffles.



Dimensions given in inches (mm).

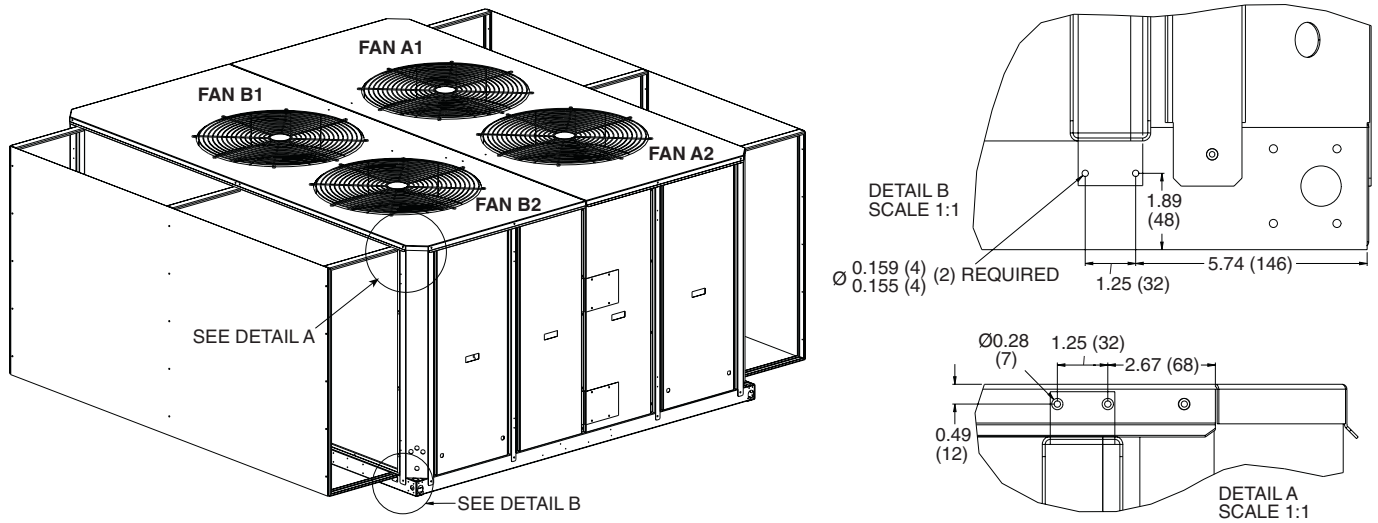
Fig. 1 — Bracket Dimensions



Dimensions given in inches (mm).

UNIT SIZE	DIM A	DIM B
30RAN010-018, 30RAN032-040 (circuit B side)	68.92 (1751)	34.46 (875)
30RAN022-030, 30RAN032-040 (circuit A side) 30RAN042-055	96.00 (2438)	48.00 (1291)

Fig. 2 — Baffle Dimensions



NOTE: Dimensions in inches (mm).

Fig. 3 — Typical Baffle Location Sizes 032-055 (042-055 Shown)

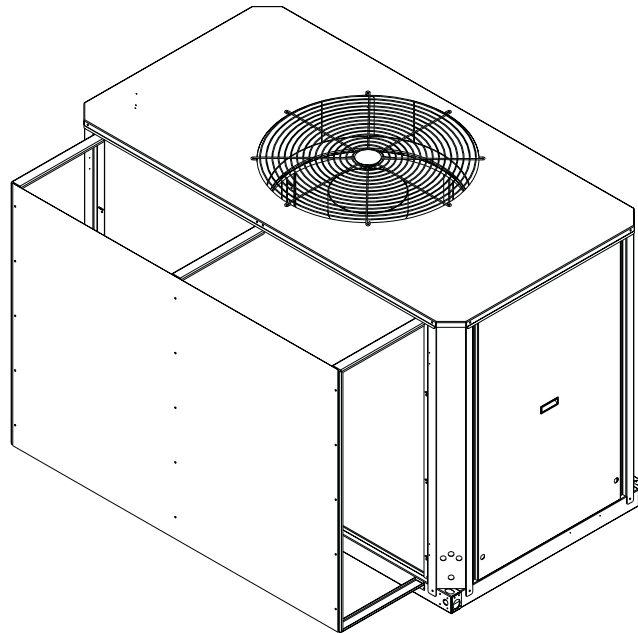


Fig. 4 — Baffle Location (Sizes 010-030)

Table 1A — Package Contents of Motormaster® V Control for 30RA010-030

30RA MODELS VOLTAGES	MOTORMASTER V ACCESSORY PART NO.	ITEM #	ITEM QTY	ITEM DESCRIPTION	ITEM PART NO.
208/230 V (60 Hz) 230 V (50 Hz)	30RA-900---006	1	1	Control	HR46TN001
		2	8	Mounting Screws	AL56AU166
		3	1	Control Box	30RA500381
		4	1	Control Cover	30RA500519
		5	1	Motor Plug Cable	30RA400707
		6	1	Power Supply Cable	30RA400706
		7	1	Transducer Connector	30RA400698
		8	1	Pressure Transducer	HK05YZ007
		9	1	Inrush Current Limiter	30RA401350
380/415/460 V 50 & 60 Hz	30RA-900---015	1	1	Control	HR46TN002
		2	8	Mounting Screws	AL56AU166
		3	1	Control Box	30RA500381
		4	1	Control Cover	30RA500519
		5	1	Motor Plug Cable	30RA400707
		6	1	Power Supply Cable	30RA400706
		7	1	Transducer Connector	30RA400698
		8	1	Pressure Transducer	HK05YZ007
		9	1	Inrush Current Limiter	30RA401351
575 V, 60 Hz	30RA-900---016	1	1	Control	HR46TN003
		2	8	Mounting Screws	AL56AU166
		3	1	Control Box	30RA500381
		4	1	Control Cover	30RA500519
		5	1	Motor Plug Cable	30RA400707
		6	1	Power Supply Cable	30RA400706
		7	1	Transducer Connector	30RA400698
		8	1	Pressure Transducer	HK05YZ007
		9	1	Inrush Current Limiter	30RA401351

Table 1B — Package Contents of Motormaster V Control for 30RA032-055

30RA MODELS VOLTAGES	MOTORMASTER V ACCESSORY PART NO.	ITEM #	ITEM QTY	ITEM DESCRIPTION	ITEM PART NO.
208/230 V (60 Hz) 230 V (50 Hz)	30RA-900---017	1	2	Control	HR46TN001
		2	8	Mounting Screws	AL56AU166
		3	2	Mounting Screws	AC41AB126
		4	1	Motor Cable A1	30RA401347
		5	1	Motor Cable B1	30RA401389
		6	1	Power Cable, Fan A1	30RA400711
		7	1	Power Cable, Fan B1	30RA400710
		8	2	Transducer Connector	30RA400708,709
		9	2	Pressure Transducer	HK05YZ007
		10	2	Inrush Current Limiter	30RA401350
		11	1	Current Limiter Mounting Bracket	30RA501404
380/415/460 V 50 & 60 Hz	30RA-900---018	1	2	Control	HR46TN002
		2	8	Mounting Screws	AL56AU166
		3	2	Mounting Screws	AC41AB126
		4	1	Motor Cable A1	30RA401347
		5	1	Motor Cable B1	30RA401389
		6	1	Power Cable, Fan A1	30RA400711
		7	1	Power Cable, Fan B1	30RA400710
		8	2	Transducer Connector	30RA400708,709
		9	2	Pressure Transducer	HK05YZ007
		10	2	Inrush Current Limiter	30RA401351
		11	1	Current Limiter Mounting Bracket	30RA501404
575 V, 60 Hz	30RA-900---019	1	2	Control	HR46TN003
		2	8	Mounting Screws	AL56AU166
		3	2	Mounting Screws	AC41AB126
		4	1	Motor Cable A1	30RA401347
		5	1	Motor Cable B1	30RA401389
		6	1	Power Cable, Fan A1	30RA400711
		7	1	Power Cable, Fan B1	30RA400710
		8	2	Transducer Connector	30RA400708,709
		9	2	Pressure Transducer	HK05YZ007
		10	2	Inrush Current Limiter	30RA401351
		11	1	Current Limiter Mounting Bracket	30RA501404

Control Mounting

30RA010-030 — Mount the Motormaster® V electronic control on the fan deck leg using the four screws provided as shown in Fig. 5.

30RA032-055 — Insert the two inrush current limiter plugs into the mounting bracket (30RA501345). Use the two screws provided to mount the inrush current limiter bracket to the left side of the control panel bottom in the pre-drilled holes. Mount the Motormaster V electronic controls on the left side of the control panel using the eight screws provided as shown in Fig. 6.

Control Wiring

⚠ CAUTION

DO NOT connect incoming AC power to the output terminal T1, T2, and T3! Severe damage to the drive will result.

⚠ WARNING

Hazard of electrical shock! Wait three minutes after disconnecting incoming power before servicing drive. Capacitors retain charge after power is removed.

⚠ CAUTION

DO NOT route the pressure transducer cable(s) with any of the power wiring. Bundling the power and transducer wires together can potentially cause interference and cause the drive to operate improperly.

30RA010-018: TWO-SPEED MOTOR (See Fig. 7)

1. Unplug the low speed motor cable, cable no. 1, at the contactor FC-LS. Unplug the other end of this cable from the motor (low speed connection, right side of motor, cable no. 1). This cable is no longer used.
2. Route the motor plug cable from the accessory to the motor and connect cable to the low speed connector. Verify that the other end of this cable is connected to the shorting plug (two short black jumper wires) at the bottom left of the Motormaster V accessory.
3. Unplug the high-speed motor cable, cable no. 2, at the contactor FC-HS. Remove this cable from the control panel and connect it to the other plug at the bottom right of the Motormaster V accessory. Verify that the wires from this plug are connected to the T1, T2 and T3 output terminals of the drive.
4. Route the power supply cable from the side of the accessory into the control panel and connect the plug to the FC-HS contactor receptacle.
5. Install the pressure transducer on the 1/4-in. flare fitting on the liquid line.
6. Plug the transducer connector from the side of the accessory into the pressure transducer.

30RA022-030: Single Speed Motor (See Fig. 7)

1. Unplug the motor cable from the A1 motor at the contactor FC-A1. Remove this cable from the control panel and connect it to the plug at the bottom right of the Motormaster V accessory. Verify that the wires from this plug are connected to the T1, T2 and T3 output terminals of the drive. Do NOT make any connection to the shorting plug in the accessory for these sizes. Also, the motor plug cable from the accessory is not used for these sizes.
2. Route the power supply cable from the side of the accessory into the control panel and connect the plug to the FC-A1 contactor receptacle.

3. Install the pressure transducer on the 1/4-in. flare fitting on the liquid line.
4. Plug the transducer connector from the side of the accessory into the pressure transducer.

30RA032-055: (See Fig. 6)

Circuit A: (30RA032-055)

1. Unplug the motor cable from the A1 motor at the contactor FC-A1. Using the A1 motor cable in the accessory (30RA401347), connect the stripped leads marked '1,' '2' and '3' to the drive output terminals marked 'T1,' 'T2,' and 'T3.' Route the plug end of this cable over to the FC-A1 contactor and connect it to the A1 motor plug.
2. Using the A1 power cable in the accessory (30RA400711), connect the stripped leads marked '1,' '2' and '3' to the drive input terminals marked 'L1,' 'L2,' and 'L3.' Route the plug at this end of the cable down to the left inrush current limiter receptacle and connect. Route the other end of this cable to the FC-A1 contactor and connect it to the receptacle attached to the contactor.
3. Install the pressure transducer on the 1/4-in. flare fitting on the Circuit A liquid line.
4. Route the transducer connector cable out the bottom of the control panel and plug it into the pressure transducer.

Circuit B: (30RA032-040)

1. Unplug the low speed motor cable, cable no. 1, at the contactor FC-LS. Remove the plug from this cable. Strip and wire nut the black, white and red leads together. Connect the ground wire to the control panel back.
2. Unplug the motor cable from the high-speed contactor FC-HS. Using the B1 motor cable in the accessory (30RA401389), connect the stripped leads marked '1,' '2' and '3' to the drive output terminals marked 'T1,' 'T2,' and 'T3.' Route the plug end of this cable over to the FC-HS contactor and connect it to the B1 high-speed motor plug.
3. Using the B1 power cable in the accessory (30RA400710), connect the stripped leads marked '1,' '2' and '3' to the drive input terminals marked 'L1,' 'L2,' and 'L3.' Route the plug at this end of the cable to the right inrush current limiter receptacle and connect. Route the other end of this cable to the FC-HS contactor and connect it to the receptacle attached to the contactor.
4. Install the pressure transducer on the 1/4-in. flare fitting on the Circuit B liquid line.
5. Route the transducer connector cable out the bottom of the control panel and plug it into the pressure transducer.

Circuit B: (30RA042-055)

1. Unplug the motor cable from the B1 motor at the contactor FC-B1. Using the B1 motor cable in the accessory (30RA401389), connect the stripped leads marked '1,' '2' and '3' to the drive output terminals marked 'T1,' 'T2,' and 'T3.' Route the plug end of this cable over to the FC-B1 contactor and connect it to the B1 motor plug.
2. Using the B1 power cable in the accessory (30RA400710), connect the stripped leads marked '1,' '2' and '3' to the drive input terminals marked 'L1,' 'L2,' and 'L3.' Route the plug at this end of the cable to the right inrush current limiter receptacle and connect. Route the other end of this cable over to the FC-B1 contactor and connect it to the receptacle attached to the contactor.
3. Install the pressure transducer on the 1/4-in. flare fitting on the Circuit B liquid line.
4. Route the transducer connector cable out the bottom of the control panel and plug it into the pressure transducer.

Adjust the Configuration Jumper — Depending on the unit nameplate voltage, install the provided jumper on the control terminal 2 to the proper location as listed in the Table 2.

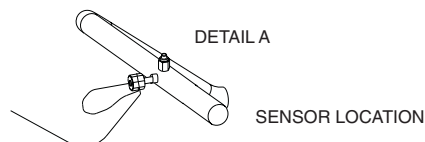
NOTE: This jumper must be installed for the control to generate any output.

Table 2 — Configuration Jumper Location

UNIT VOLTAGE	MOTORMASTER® V CONTROL PART NUMBER	CONFIGURATION JUMPER LOCATION
208-3-60	HR46TN001	13A
230-3-60	HR46TN001	1
380-3-60	HR46TN002	13A
460-3-60	HR46TN002	1
575-3-60	HR46TN003	1
230-3-50	HR46TN001	13B
380-3-50	HR46TN002	13C
415-3-50	HR46TN002	13C

Configure Unit for Motormaster V Electronic Control Operation — The unit must be configured for the Motormaster V electronic control operation. Use the Scrolling Marquee display to configure the system as following:

1. Set the Enable/Off/Remote switch to OFF position.



2. Press the **ESCAPE** key until the screen is blank and use the arrow key to select the Configuration mode LED.
3. Press **ENTER** key, then use **▼** key to select the sub-mode 'OPT1', then press **ENTER** key.
4. Press **▼** until 'MMR.S' displayed.
5. Press **ENTER** key twice. The word 'PASS' and 'WORD' will flash.
6. Press 1 1 1 1 then **ENTER** key so that 'NO' flashes.
7. Use arrow keys to change to 'YES' and press **ENTER** key.
8. Return the Enable/Off/Remote switch to the proper position.

The chiller is now configured for Motormaster control.

Test the Motormaster V Electronic Control Option Output — Follow the instructions given in the Controls Start-Up, and Troubleshooting Guide to verify proper operation of Motormaster V electronic control and the outdoor-fan motors.

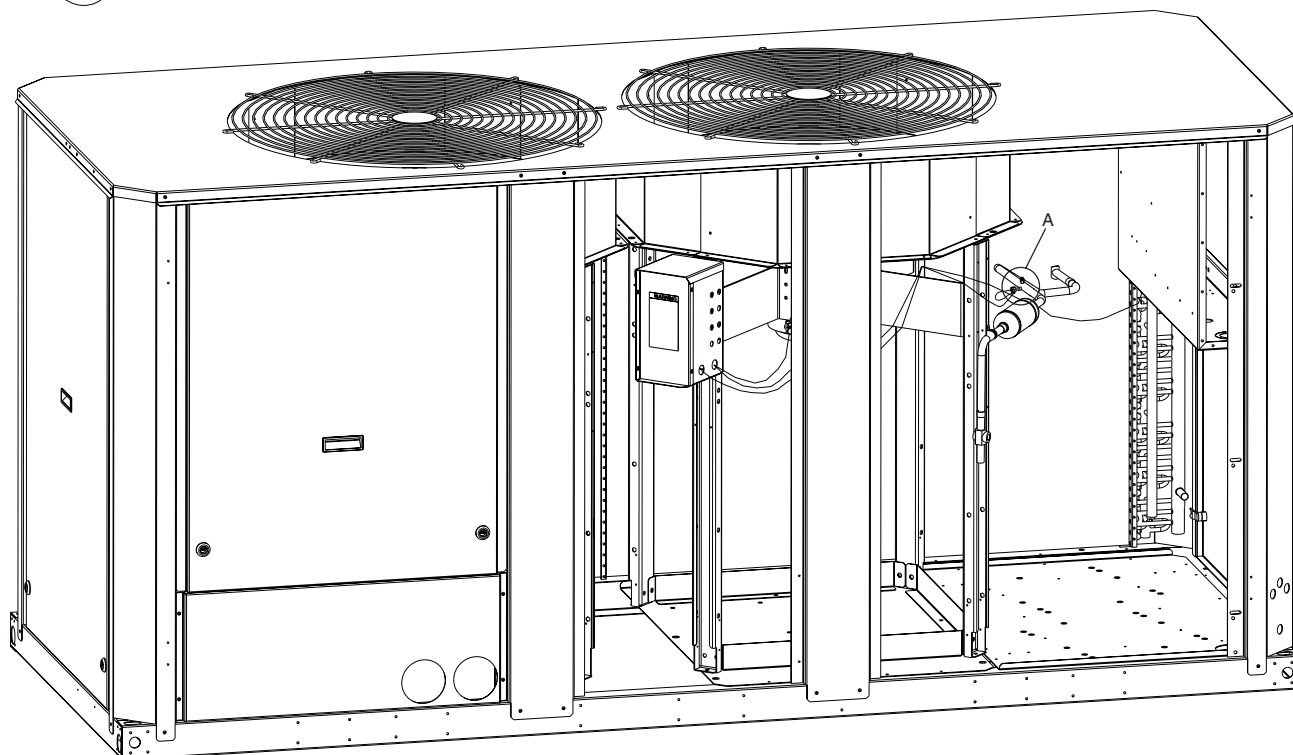


Fig. 5 — Typical Control Mounting Location for Sizes 010-030 (Sizes 022-030 Shown)

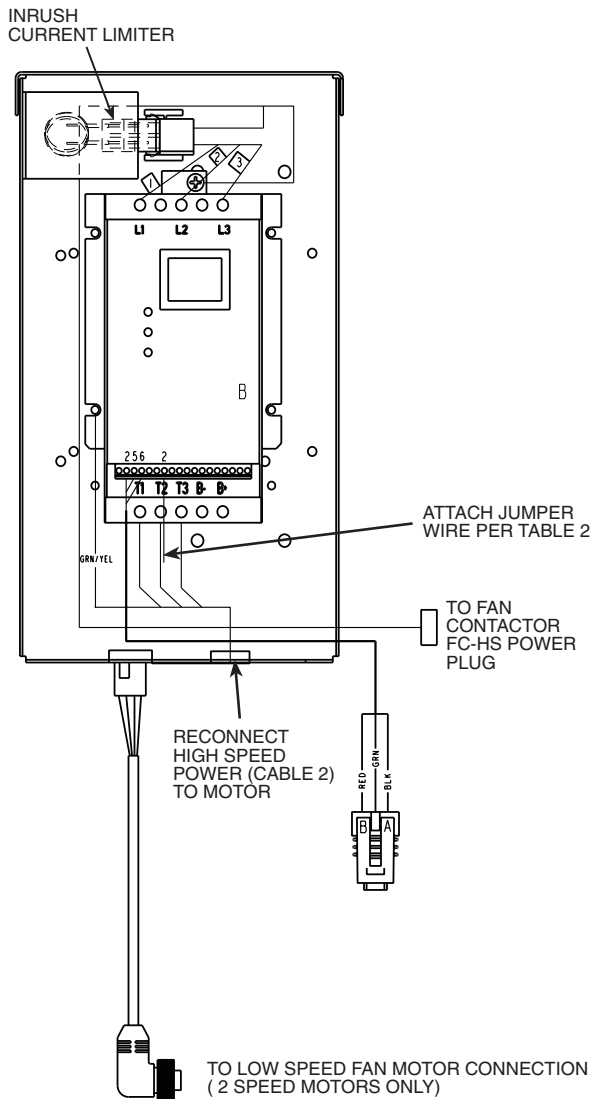


Fig. 7 — Control Power Wiring (Sizes 010-030)

When the system calls for the fan, the fan contactor will be energized to power the Motormaster® V electronic control. The LED will display the speed of the motor. The display range will be 8 to 50 Hz for 50 Hz units and 8 to 60 Hz for 60 Hz units.

The Motormaster V control will start the condenser fan when the compressor engages. The control will adjust the fan speed to maintain approximately 135 psig liquid line pressure. Above that pressure, the fan should operate at full speed.

To test the control and motor, in the TEST mode, run any compressor in each circuit. The Motormaster V electronic control adjusts the fan speed based on the liquid pressure input.

START-UP

Low Ambient Application Notes

ONE-FAN CIRCUITS — The fan is equipped with a two-speed motor. *ComfortLink*™ controls call for high speed operation when a compressor is engaged. The Motormaster V device controls the fan speed to maintain the minimum head pressure set point.

TWO-FAN CIRCUITS — The first fan will be controlled by Motormaster V electronic control to maintain the minimum discharge pressure.

The second fan is regulated by the *ComfortLink* control to cycle between 156 and 243 psig discharge pressure.

Motormaster V Control — The Motormaster V electronic control uses a 0 to 5 VDC signal input from a pressure transducer attached to the liquid line service valve gage port on each circuit. The pressure transducer is connected to terminals 2, 5 and 6 on the controller. The controller is factory configured and requires no field programming. If drive does not function properly, the information provided below and Table 3 can be used to troubleshoot the drive.

⚠ WARNING

If input power has not been applied to the drive for a period of time exceeding three years (due to storage, etc.), the electrolytic DC bus capacitors within the drive can change internally, resulting in excessive leakage current. This can result in premature failure of the capacitors if the drive is operated after such a long period of inactivity or storage. In order to reform the capacitors and prepare the drive for operation after a long period of inactivity, apply input power to the drive for 8 hours prior to actually operating the motor. Before attempting to operate the drive, motor, and driven equipment, be sure all procedures pertaining to installation and wiring have been properly followed.

⚠ WARNING

DO NOT connect incoming AC power to output terminals T1, T2, and T3! Severe damage to the drive will result. Do not continuously cycle input power to the drive more than once every two minutes. Damage to the drive will result.

⚠ WARNING

Hazard of electrical shock! Wait three minutes after disconnecting incoming power before servicing drive. Capacitors retain charge after power is removed. Drive assembly includes externally mounted current limiting resistors. Use extreme caution when servicing the drive.

⚠ WARNING

When configured as shown below, this equipment is designed to start when it receives line power. Ensure that all personnel are clear of fans and guards are installed before applying power.

⚠ CAUTION

It is strongly recommended that the user NOT change any programming without consulting Carrier service personnel. Unit damage may occur from improper programming.

Motormaster V electronic control is configured according to the inputs provided. No additional programming is necessary.

The drive can display 71 program parameters. Parameters 50-71 are monitor functions and cannot be changed. The remainder of the parameters can be changed after entering a password.

To enter password and change program values:

1. Press **Mode** button.
2. Upper right decimal point blinks.

- Display reads “00” (see Fig. 9). To enter the PROGRAM mode to access the parameters, press the **Mode** button (see Fig. 9). This will activate the PASSWORD prompt (if the password has not been disabled). The display will read “00” and the upper right-hand decimal point will be blinking.
- Use the ▲ and ▼ buttons to scroll to the password value (the factory default password is “111”) and press the **Mode** button. Once the correct password value is entered, the display will read “P01”, which indicates that the PROGRAM mode has been accessed at the beginning of the parameter menu (P01 is the first parameter).

NOTE: If the display flashes “Er”, the password was incorrect, and the process to enter the password must be repeated.

- Press **Mode** to display present parameter setting. Upper right decimal point blinks.

Use the ▲ and ▼ buttons to scroll to the desired parameter number.

Once the desired parameter number is found, press the Mode button to display the present parameter setting. The upper right-hand decimal point will begin blinking, indicating that the present parameter setting is being displayed, and that it can be changed by using the up and down buttons. Use ▲ and ▼ to change setting. Press **Mode** to store new setting.

Pressing the **Mode** button will store the new setting and also exit the PROGRAM mode. To change another parameter, press the **Mode** button again to re-enter the PROGRAM mode (the parameter menu will be accessed at the parameter that was last

viewed or changed before exiting). If the **Mode** button is pressed within two minutes of exiting the PROGRAM mode, the password is not required access the parameters. After two minutes, the password must be entered in order to access the parameters again.

To change password: first enter the current password then change parameter P44 to the desired password.

LIQUID LINE PRESSURE SET POINT ADJUSTMENT — Adjusting the set point is not recommended due to possible interaction with other head pressure software algorithms or controls. For single fan units or situations where the set point must be changed, the set point is found in P34. A higher value will result in a higher liquid line set point. Example: Increasing the set point from 18.0 to 18.1 will increase the liquid line pressure by approximately 10 psi.

FAULT CODES — The drive is programmed to automatically restart after a fault and will attempt to restart three times after a fault (the drive will not restart after CF, cF, GF, F1, F2-F9, or Fo faults). If all three restart attempts are unsuccessful, the drive will trip into FAULT LOCKOUT (LC), which requires a manual reset.

NOTE: Since faults may be reset as incoming power is cycled, you may need to observe current fault code before the Carrier unit control turns off the VFD. Most recent faults can be accessed using parameter 50. If necessary, force condenser fan contactor “ON” using Service Tool or jumper box and remove start jumper. This will allow programming and access to fault history.

MANUAL RESET — If fault condition has been removed, cycle power to the chiller to reset the VFD.

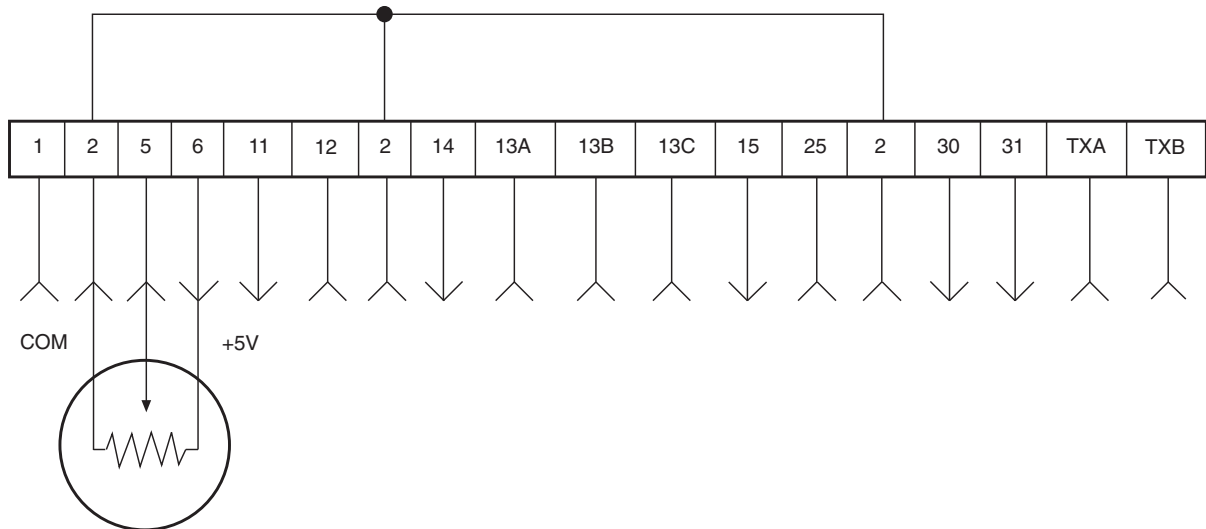


Fig. 8 — Pressure Transducer and Start Command Configuration Jumper Wiring



Fig. 9 — Mode Buttons and Mode Display

TROUBLESHOOTING

Troubleshooting the Motormaster® V control requires a combination of observing system operation and VFD information. The drive provides 2 kinds of troubleshooting modes: a status matrix using the 3-digit display (P57, P58) and real time monitoring of key inputs and outputs. The collective group is displayed through parameters 50-71 and all values are read-only. The key read-only outputs are:

- **P50: FAULT HISTORY** — Last 8 faults
- **P51: SOFTWARE version**

- **P52: DC BUS VOLTAGE** — in percent of nominal. Usually rated input voltage x 1.4
- **P53: MOTOR VOLTAGE** — in percent of rated output voltage
- **P54: LOAD** — in percent of drives rated output current rating
- **P55: VDC INPUT** — in percent of maximum input: 100 will indicate full scale which is 5 v
- **P56: 4-20 mA INPUT** — in percent of maximum input. 20% = 4 mA, 100% = 20 mA

Refer to Table 3 for more troubleshooting information.

Table 3 — Fault Codes

FAULT CODE	DESCRIPTION	SOLUTION
AF	High Temperature Fault: Ambient temperature is too high; Cooling fan has failed (if equipped).	Check cooling fan operation
CF	Control Fault: A blank EPM, or an EPM with corrupted data has been installed.	Perform a factory reset using Parameter 48 — PROGRAM SELECTION.
cF	Incompatibility Fault: An EPM with an incompatible parameter version has been installed.	Either remove the EPM or perform a factory reset (Parameter 48) to change the parameter version of the EPM to match the parameter version of the drive.
GF	Data Fault: User data and OEM defaults in the EPM are corrupted.	Restore factory defaults P48, see section above. If that does not work, replace EPM.
HF	High DC Bus Voltage Fault: Line voltage is too high; Deceleration rate is too fast; Overhauling load.	Check line voltage — set P01 appropriately
JF	Serial Fault: The watchdog timer has timed out, indicating that the serial link has been lost.	Check serial connection (computer) Check settings for PXX Check settings in communication software to match PXX
LF	Low DC Bus Voltage Fault: Line voltage is too low.	Check line voltage — set P01 appropriately
OF	Output Transistor Fault: Phase to phase or phase to ground short circuit on the output; Failed output transistor; Boost settings are too high; Acceleration rate is too fast.	Reduce boost or increase acceleration values. If unsuccessful, replace drive.
PF	Current Overload Fault: VFD is undersized for the application; Mechanical problem with the driven equipment.	Check line voltage — set P01 appropriately Check for dirty coils Check for motor bearing failure
SF	Single-phase Fault: Single-phase input power has been applied to a three-phase drive.	Check input power phasing
F1	EPM Fault: The EPM is missing or damaged.	
F2-F9, Fo	Internal Faults: The control board has sensed a problem	Consult factory
Drive display = 60.0 even though it is cold outside and it should be running slower	Feedback signal is above set point	Check for proper set point Check liquid line pressure
Drive display = '---' even though drive should be running	Start jumper is missing	Replace start jumper.
Drive display = 8.0 even though fan should be running faster	Feedback signal is below set point and fan is at minimum speed	Check for proper set point Check liquid line pressure
VFD flashes 57 (60 Hz units), 47 (50 Hz units) and LCS	Feedback or speed signal lost. Drive will operate at 57/47 Hz until reset or loss of start command. Resetting requires cycling start command (or power).	In stand alone mode: Check transducer wiring and feedback voltage. Feedback voltage displayed on P-69. Pin 6 should be 5 v output. Pin 5 (feedback) should be somewhere between 0 and 5 v.
VFD not slowing down even though liquid line pressure is below set point.	1. Faulty pressure transducer output. 2. VFD set for manual control.	1. Check VDC signal between TB5 and TB2. Should be in range of 0.5 v to 4.5 v. 2. Restore VFD to automatic control. Change Parameter P05 back to correct value shown in Table 2.

LEGEND

EPM — Electronic Programming Module
LCS — Loss of Control Signal
OEM — Original Equipment Manufacturer

